

REINSTATEMENT OF *VIBURNUM OZARKENSE*
(CAPRIFOLIACEAE): AN ENDEMIC TAXON OF THE
INTERIOR HIGHLANDS OF
ARKANSAS, MISSOURI AND OKLAHOMA

Timothy J. Weckman

*Department of Biological Sciences
Eastern Kentucky University
Richmond, KY 40475, U.S.A.*

ABSTRACT

Based on field work and morphological analysis of herbarium specimens, *Viburnum ozarkense* Ashe is reinstated as a distinct species. Recognition of the occurrence and distribution of *V. ozarkense* has been compromised by its reduction to synonymy under *Viburnum molle* Michx. A morphological characterization of *V. ozarkense* and *V. molle*, a key to species, and a distribution map are provided. This research supports the recognition of *V. ozarkense* as an endemic shrub of the Interior Highlands of Arkansas, Missouri and Oklahoma.

RESUMEN

Basados en trabajo de campo y análisis morfológico de especímenes de herbario, *Viburnum ozarkense* Ashe se repone como una especie distinta. El reconocimiento de la ocurrencia y distribución de *V. ozarkense* ha estado comprometido por su reducción a sinónimo de *Viburnum molle* Michx. Se ofrecen una caracterización morfológica de *V. ozarkense* y *V. molle*, una clave de especies, y un mapa de distribución. Esta investigación apoya el reconocimiento de *V. ozarkense* como un arbusto endémico de las montañas Ouachita y Ozark de Arkansas, Missouri y Oklahoma.

INTRODUCTION

Viburnum ozarkense was described from material W. W. Ashe collected in Stone County, Arkansas with the type locality providing the only distributional reference (Ashe 1928). Ashe was a prolific collector, amassing some 30,000 specimens by his death (Massey 2001). Ashe also published 510 species and varietal names from these collections, but many have been reduced to synonymy (Coker et al. 1932). *Viburnum molle* was described by Michaux from material he collected in Kentucky in the late 1700s (Michaux 1803). Ashe was aware of *V. molle* Michx., and provided characteristics to separate *V. ozarkense* from *V. molle* in his species description. Original material from both of these collections has not been readily accessible to American botanists: the Michaux collection of *V. molle* was deposited in the Paris herbarium (P) (acronyms after Holmgren et al. 1990), and most of Ashe's collections were inaccessible in his private herbaria at the time of his death (Coker et al. 1932).

The name *V. ozarkense* was retained in an early checklist for Arkansas (Moore 1941) and in a generic treatment of *Viburnum* by McAtee (1956). How-

ever, it was reduced to synonymy under *V. molle* Michx. by Steyermark (1963) and this placement has been followed by current treatments (Tucker 1976; Smith 1988; USDA, NRCS 2002). Neither taxon is currently monitored by heritage programs in Arkansas, Missouri or Oklahoma. Based on morphological analysis of *Viburnum ozarkense* and *V. molle*, I recognize these taxa as distinct, provide a key to differentiate them, and map the current distribution of both taxa in Arkansas, Missouri and Oklahoma.

MATERIALS AND METHODS

Loans were requested from herbaria with Ashe collections: A, GH, ILL, L, LCU, MO, NCU, POM, and US, and certain herbaria having Arkansas, Missouri and Oklahoma *Viburnum* material: APCR, BRIT, NA, NYBG, OKL, SMS, UAM, UARK, and UMO. Additional specimens were collected during field work in Arkansas, Missouri and Oklahoma in 1999–2001.

Measurements were recorded for 14 quantitative characteristics: leaf size, toothing, venation, length of leaf tip, petiole length on fertile and vegetative shoots, peduncle length, number of rays, inflorescence width and height, corolla width, stamen length and fruit length and width. Qualitative characteristics including leaf shape, leaf and petiole pubescence, the presence, placement and pubescence on stipules and inflorescence bracts, flowering times and shoot pubescence and color were noted. Mensural and qualitative data were used to prepare a diagnostic key for the species.

Habitat and associate information was gleaned from vouchers and from field work. A distribution map of all known populations of *V. ozarkense* and *V. molle* occurring in Arkansas, Missouri and Oklahoma was prepared from annotated loans and new collections.

RESULTS AND DISCUSSION

Loans resulted in 236 vouchers for study. An additional 119 collections were produced from field work during 1999–2001 in Arkansas, Missouri and Oklahoma. Of these, 193 were referable to *Viburnum ozarkense* and 162 to *V. molle*. They are all listed in the specimens examined section for each taxon.

Mensural results

Mensural analysis indicates that the most useful features for differentiating *Viburnum ozarkense* from *V. molle* are leaf width, number of teeth per half leaf, number of veins per half leaf, leaf tip length, petiole length below an inflorescence or at the apex of a vegetative shoot, corolla width and fruit length. The means of these characters were all statistically significantly different (Table 1). Measured features not significantly different between the species were leaf length, peduncle length, inflorescence width and height, stamen length and fruit width.

Based on my measurements leaves in *Viburnum ozarkense* averaged 7.2 cm wide, with 5.3 veins and 13.9 teeth per half leaf, and had an acuminate apex averaging 7.7 mm long. Leaves of *V. molle* were wider, averaging 8.2 cm broad, with 6.1 veins; more toothed, averaging 25.6 teeth per half leaf; and with an acute apex averaging 2.9 mm long. *Viburnum ozarkense* petioles on both flowering and sterile shoots are shorter than those of *V. molle*. The first petioles below an inflorescence averaged 1.1 cm in *V. ozarkense* and 2.4 cm for *V. molle*. Petioles on the distal ends of vegetative shoots are similarly shorter on *V. ozarkense* shoots (\bar{x} = 2.1 cm) than *V. molle* shoots (\bar{x} = 3.4 cm). Corollas were significantly wider in *V. ozarkense* flowers (\bar{x} = 6.6 mm) than in *V. molle* flowers (\bar{x} = 4.4 mm), but these data were derived from a small sample (n = 40). Mature fruits were significantly longer in *V. ozarkense* (\bar{x} = 1.1 cm) than in *V. molle* (\bar{x} = 0.9 cm), but again, sample size was small (n = 41). Vegetative specimens of these taxa are differentiated based on the number of teeth per half leaf. This characteristic overlaps in only a few individuals with distinct peaks well separated (Fig. 1).

Qualitative characteristics

Qualitative features such as leaf shape, leaf and petiole pubescence, color of current year shoots and bark features also provided useful characteristics to separate the species (Table 1). In outline, *Viburnum molle* leaves are broadly ovate or orbicular; those of *V. ozarkense* are narrower and appear ovate in outline. Adaxial leaf surfaces of *V. ozarkense* are uniformly hirsute, with short hairs (ca. 0.25 mm long) across the surface. In contrast, adaxial surfaces of *V. molle* leaves are glabrous or may have a few scattered red, glandular hairs. Similarly, petioles of *V. ozarkense* are pubescent, covered with moderate to dense strigose and glandular hairs and an open furrow. Petioles of *V. molle* are essentially glabrous and any observed pubescence is typically manifested as a few glandular hairs at the distal end of the petiole or as a few villous hairs along the margin of the closed petiole furrow. Stipules are present in both species; in *V. molle* these occur in single pairs, while in *V. ozarkense* two pairs of stipules per leaf stalk are often observed. In cross section, *V. ozarkense* petioles appear oval while *V. molle* petioles appear terete. The color of current year shoots at mid-season also provides a useful way to differentiate these taxa. For *V. ozarkense* they are reddish-brown, in contrast to the yellow-tan shoots of *V. molle*. The most obvious field character separating these viburnums is the presence of exfoliating bark persistent on stems after the second year of growth on *V. molle* shoots versus the tight bark throughout the branching of *V. ozarkense*. Although this is a prominent field character, it is not consistently present on herbarium sheets, as many collections do not show enough branch to capture it.

DIAGNOSTIC KEY

Leaves ovate, adaxially hirsute, 8 to 21 (mode 14) marginal teeth per half leaf; petioles of first pair of leaves below inflorescence \bar{x} = 1.0 cm, \bar{x} = 2.0 cm at tips of vegeta-

TABLE 1. Comparison of characteristics useful in differentiating *V. ozarkense* and *V. molle*. N = number of individuals measured or sampled. Data = range with means and standard deviations in parentheses. * = values significantly different at $p < .05$.

Character	N	<i>Viburnum ozarkense</i>	N	<i>Viburnum molle</i>
leaf shape	190	ovate	158	broadly ovate, orbicular
*leaf width (cm)	190	4–14 (7.2±1.4)	158	5–12 (8.2±1.3)
*number of veins/ half leaf	192	4–8 (5.4±0.65)	162	5–8 (6.1±0.69)
adaxial leaf surface pubescence	190	hirsute	158	glabrous
*number of teeth/ half leaf	192	8–21 (13.8±2.3)	162	17–44 (25.6±4.2)
*length of 1 st petiole below inflorescence (cm)	82	0.5–2.2 (1.1±0.37)	68	1–4.2 (2.4±0.52)
*length of 1 st petiole vegetative shoot (cm)	109	0.9–3.4 (2.1±0.56)	90	1.8–4.9 (3.4±0.72)
petiole pubescence	190	strigose and glandular	158	glabrous to sparse glandular
*leaf tip length (mm)	184	3–15 (7.7±2.6)	160	1–7 (2.9±1.1)
*corolla width (mm)	19	4–9 (6.6±1.5)	21	3–6 (4.4±0.78)
*fruit length (cm)	16	0.8–1.3 (1.1±0.15)	25	0.7–1.1 (0.9±0.11)
bark		tight throughout		exfoliating on >2 year old wood
current season shoot color		reddish-brown		yellow-tan

tive shoots, oval in cross-section, moderately to densely strigose and glandular, furrows open; stipules often 2 pair per leaf stalk; shoots of current season reddish-brown; twigs and stems with tight bark throughout _____ **Viburnum ozarkense**

Leaves broadly ovate to orbicular, adaxially glabrous, 17 to 44 (mode 24) marginal teeth per half leaf; petioles of first pair leaves below inflorescence \bar{x} = 2.4 cm, \bar{x} = 3.3 cm at tips of vegetative shoots, terete in cross section, glabrous or sparsely glandular, furrow closed; stipules in single pairs only; shoots of current season yellow-tan; older (>2 years) twigs and stems with exfoliating bark _____ **Viburnum molle**

Phenology

Flowering material (about 5% each of *Viburnum molle* and *V. ozarkense* vouchers) for the plants that occurred in Arkansas, Missouri and Oklahoma indicated that *V. ozarkense* flowers earlier than *V. molle*. Based on the material I examined, *V. ozarkense* flowered between May 6 and June 7, with a peak flowering time of May 19. *Viburnum molle* flowered between May 15 and May 29, with a peak on May 27–29 (Fig. 2).

Habitat and Associates

Information gleaned from herbarium labels and field experience indicated that *Viburnum ozarkense* and *V. molle* occupied similar habitats and had a similar set of associates. Most associate data were compiled from field notes of the author.

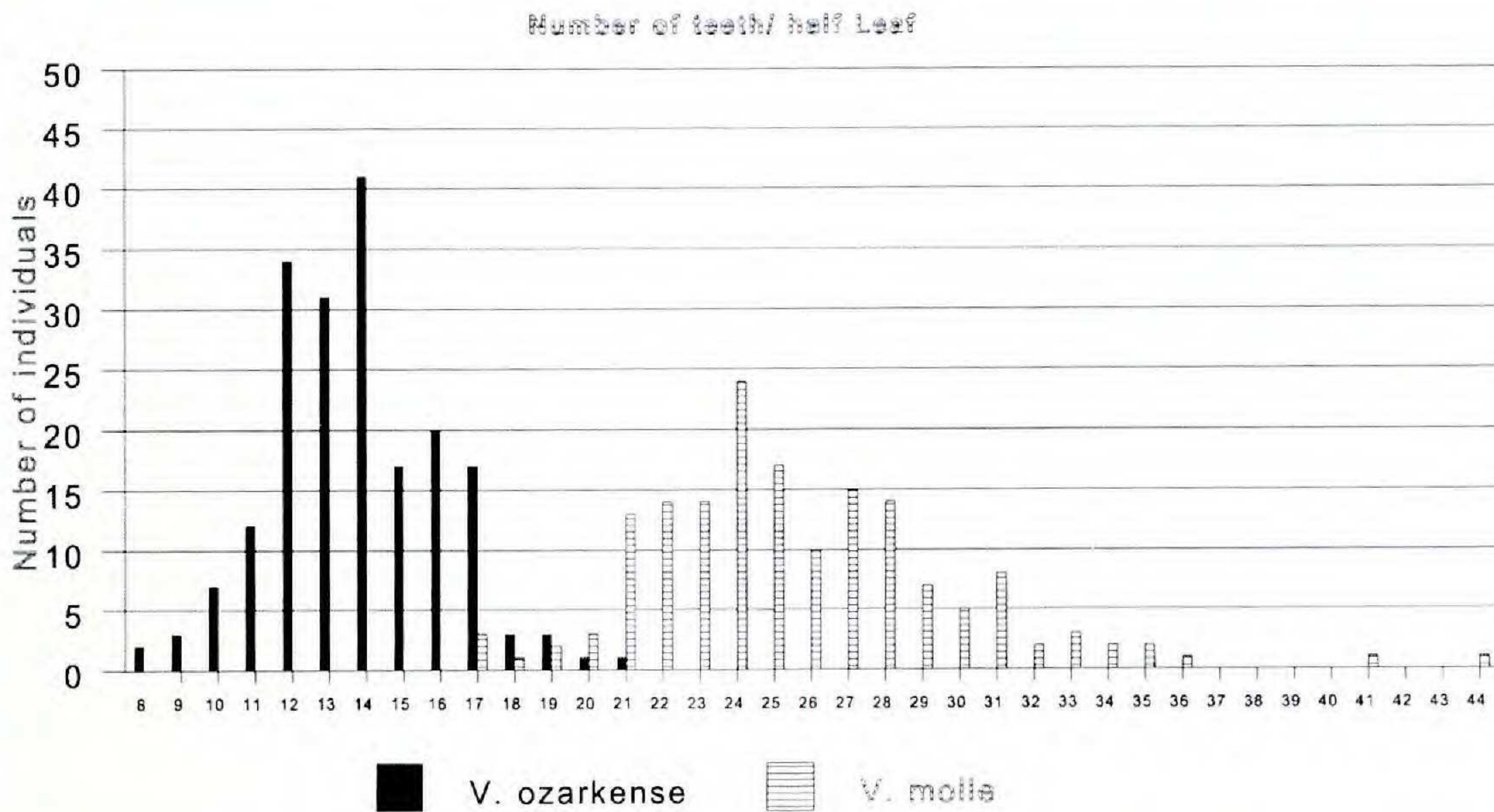


FIG. 1. Number of marginal teeth per half leaf for *Viburnum ozarkense* and *Viburnum molle* specimens collected in Arkansas, Missouri and Oklahoma.

Viburnum ozarkense

Populations of *Viburnum ozarkense* in Arkansas are most often encountered on north-facing ridges, rocky limestone hillsides and wooded slopes in rich woods. It also occurs on ledges and in rocky woods above and along creeks (ex. Alum Fork, Bard Springs, Buffalo River, Cap Fork, Little Red River and Stepp Creek). Associates of *V. ozarkense* in Arkansas include: *Acer saccharum*, *Arundinaria gigantea*, *Berchemia scandens*, *Carpinus caroliniana*, *Carya cordiformis*, *Chionanthus virginicus*, *Cornus florida*, *Diospyros virginiana*, *Dirca palustris*, *Hamamelis vernalis*, *Hydrangea arborescens*, *Magnolia acuminata*, *Philadelphus pubescens*, *Quercus muhlenbergii*, *Q. stellata*, *Rhamnus caroliniana*, *Rhus aromatica*, *Sideroxylon lanuginosum*, *Staphylea trifolia*, *Tilia americana*, *Vaccinium arboreum* and *Viburnum rufidulum*.

In Missouri, *Viburnum ozarkense* has been collected from north and north-east facing limestone ledges and bluffs above the Eleven Point River, from limestone slopes along Myatt Creek, and north facing limestone slopes along the South Fork of the Spring River. These are often mid-slope locations with filtered light. Associates of *V. ozarkense* in Missouri included: *Acer saccharum*, *Berchemia scandens*, *Carpinus caroliniana*, *Cornus florida*, *Fraxinus quadrangulata*, *Lindera benzoin*, *Ostrya virginiana*, *Quercus alba*, *Q. muhlenbergii*, *Q. rubra*, *Sideroxylon lanuginosum*, and *Viburnum rufidulum*.

In Oklahoma, *Viburnum ozarkense* has been collected from a rocky north facing chert slope above Caney Creek in Adair County, and wooded oak-pine hillsides in McCurtain County. Associates of *V. ozarkense* in Oklahoma at the

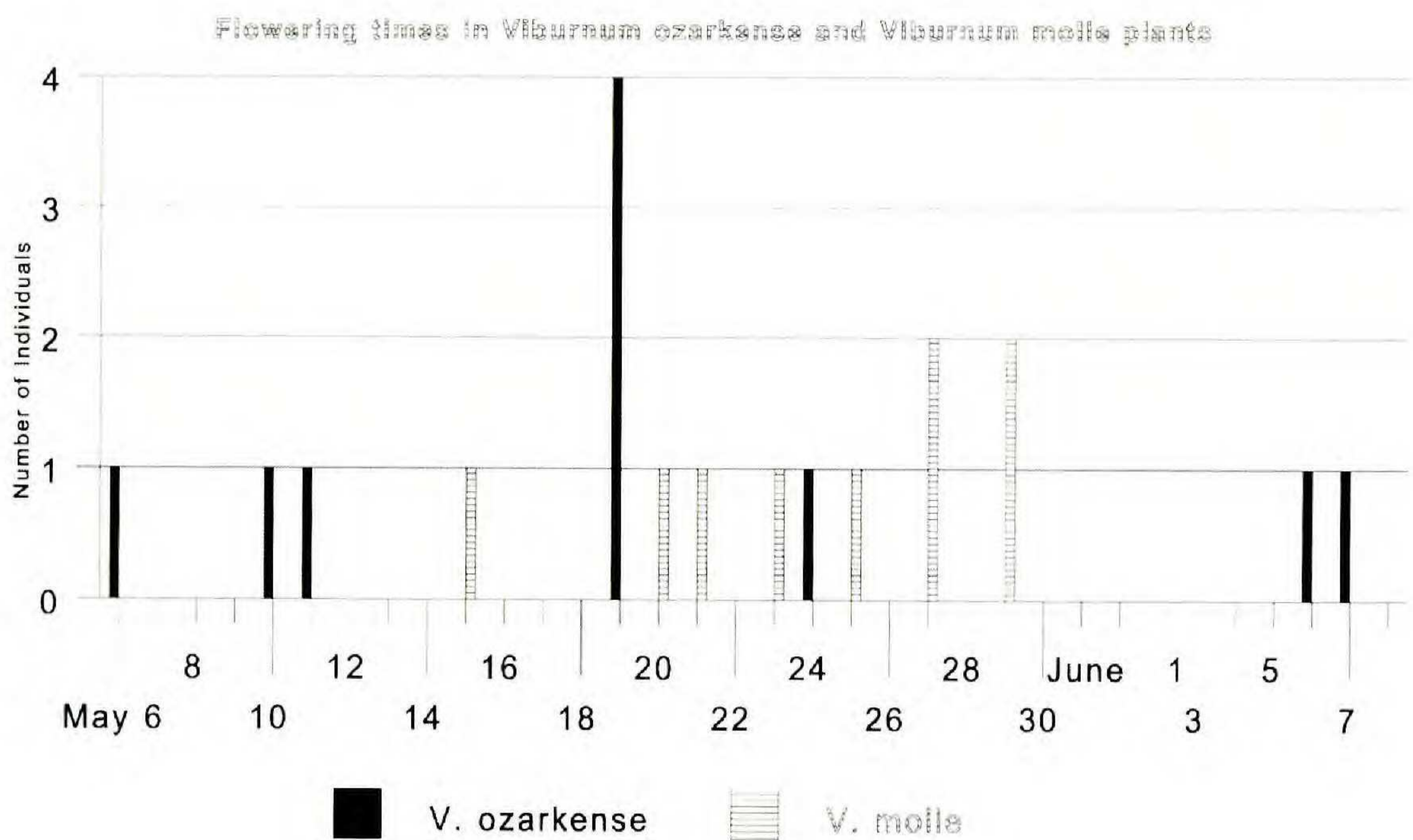


FIG. 2. Flowering phenology of *Viburnum ozarkense* and *Viburnum molle* in Arkansas, Missouri and Oklahoma.

Adair County site included: *Acer saccharum*, *A. rubrum*, *Asimina triloba*, *Cercis canadensis*, *Corylus americana*, *Hydrangea arborescens*, *Lindera benzoin*, *Nyssa sylvatica*, *Quercus alba*, *Sassafras albidum*, *Staphylea trifolia*, *Tilia americana* and *Viburnum rufidulum*.

Viburnum molle

Viburnum molle occurs in Arkansas on chert slopes at the base of north facing bluffs along War Eagle Creek in Madison County. A single collection by E.J. Palmer documented *V. molle* in Boone County from "rocky ledges, Harrison." Associates of *V. molle* in Arkansas at the War Eagle Creek site included: *Acer saccharum*, *Asimina triloba*, *Hydrangea arborescens*, *Juglans nigra*, *Lindera benzoin*, *Magnolia acuminata*, *Quercus muhlenbergii*, *Q. rubra*, *Staphylea trifolia*, and *Tilia americana*.

Habitats in Missouri which support *Viburnum molle* include north facing slopes, bluffs and limestone ledges along creeks and rivers (ex. Castor River, Cole Camp Creek, Gasconade River, Jacks Fork of Current River, James River, Jonca Creek, Lost Creek, Meramec River, Piney Creek, River Aux Vases, Stinson Creek, Swan Creek, West Fork Cuivre River). Along these creeks and rivers, *V. molle* plants typically occur as understory elements receiving filtered or part day sunlight, at the mid-slope point, neither in the floodplain nor at the more xeric ridge crest. In Missouri associates included: *Acer saccharum*, *Asimina triloba*, *Carpinus caroliniana*, *Cornus florida*, *Dirca palustris*, *Juniperus*

virginiana, *Quercus muhlenbergii*, *Sideroxylon lanuginosum*, *Tilia americana*, and *Viburnum rufidulum*.

Viburnum molle is not known to occur in Oklahoma.

Distribution and rarity

Distribution of *Viburnum ozarkense* was compiled from annotated herbarium vouchers and new collections produced for this study (Fig. 3). *Viburnum ozarkense* is confined to the Ouachita and Boston Mountains and Ozark plateau, and is documented from 14 counties in Arkansas, Howell and Oregon counties in Missouri, and Adair and McCurtain counties in Oklahoma. While some populations have been sampled repeatedly over the past 75 years, (ex. type population in Stone Co., Arkansas), others are documented by single collections. Based on herbarium material, 50% of the known populations of *V. ozarkense* have not been sampled for more than 30 years, and some populations not sampled for as long as 80 years. Some Arkansas populations have conservation protection in the Ozark National Forest, and along the Buffalo National River.

Viburnum ozarkense populations in Missouri are afforded some protection at sites along the Eleven Point River in the Mark Twain National Forest. A population examined in 2000, at the western edge of the range in Adair County, Oklahoma, was composed of about 15 individuals and is not known to have conservation protection. The size and conservation status of the McCurtain County, Oklahoma population is unknown; this population has not been sampled since 1966. With a known distribution of 18 counties in three states, *V. ozarkense* clearly falls under the 26 county upper limit for rare southeastern endemics established by Estill and Cruzan (2001). *Viburnum ozarkense* should be considered for state listing in states where it occurs and attempts should be made to locate additional populations.

The commonness or rarity of *V. molle* throughout its range has not been critically reviewed. In Arkansas, *V. molle* is restricted to Madison and Boone counties (Fig. 3). The Madison County population of *V. molle*, was discovered by Shepherd in 1987 while working for the Arkansas Natural Heritage Commission. This population was re-visited in 2001 by Weckman and Shepherd and is estimated to consist of 35–50 individuals. It is on private land with no current conservation protection. An attempt by the author to relocate the Boone County population collected by Palmer in 1914 was not successful in 2000. The terse label information, “rocky ledges, Harrison” gave few clues as to its location. This population may no longer be extant. This research indicates *V. molle* is the rarest *Viburnum* species in Arkansas.

Viburnum molle occurs in 16 counties in Missouri. A population observed in Oregon County in 2001 was estimated to consist of about 12 individuals. Labels typically lack information about numbers of plants in a population; thus sizes of other populations are unknown. In the three state study area, herbarium

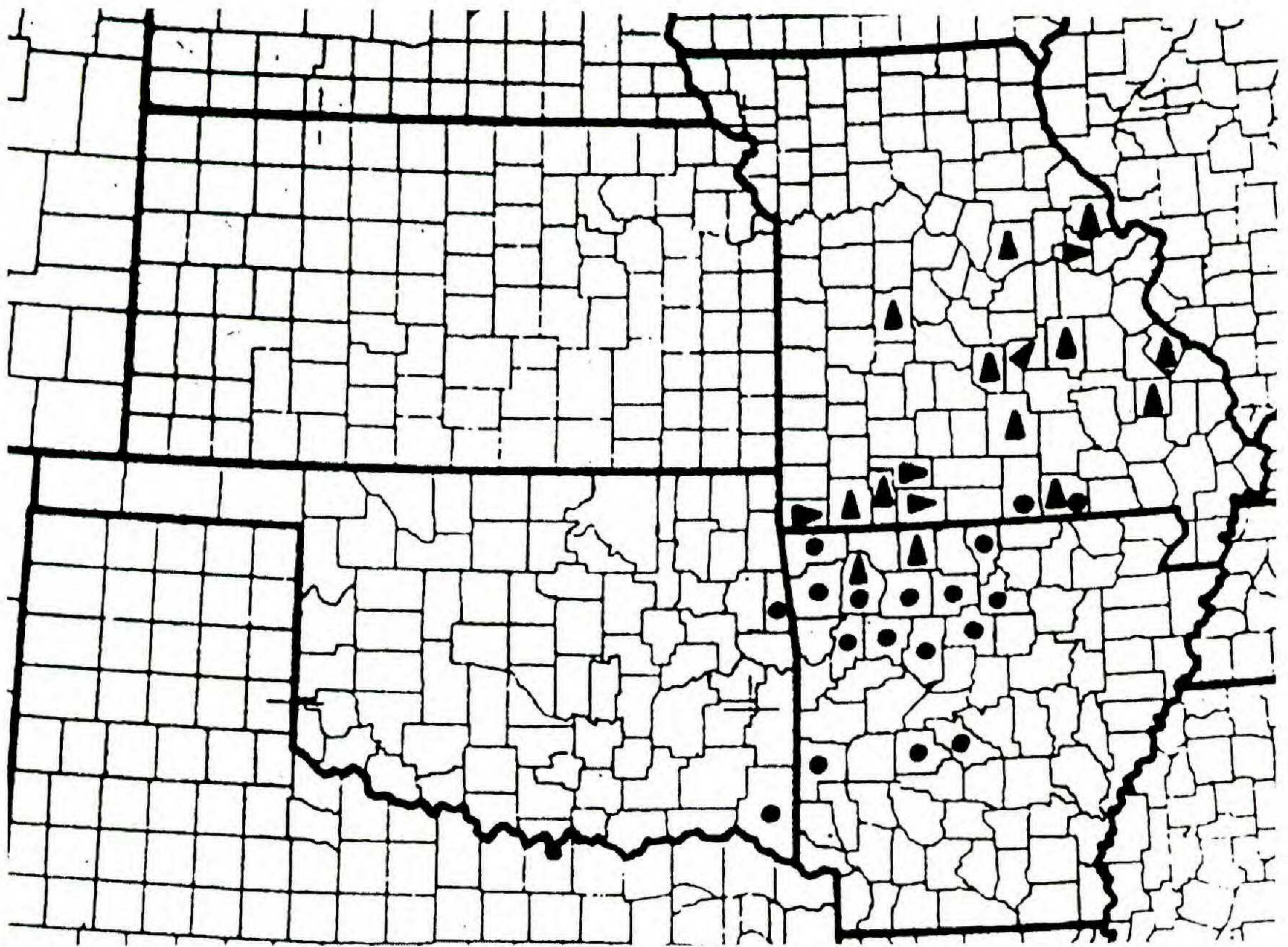


FIG. 3. Distribution of *Viburnum ozarkense* Ashe (●) and *Viburnum molle* Michx. (▲) in Arkansas, Missouri and Oklahoma, based on annotated herbarium vouchers.

vouchers examined of *V. molle* reveal that 50% of the counties were last collected in or before the 1950s. Conservation status of the Missouri populations of *V. molle* are unknown but some may be afforded protection in the various units of the Mark Twain National Forest and along the Eleven Point River.

Overlap of morphology and geographic range

For the mensural characters used in this study, ranges of the measurements overlap, however 8 of 14 characters were statistically significantly different at $p < 0.05$. If single character taxonomy is desired in the field, the *sine qua non* for *Viburnum molle* is the presence of exfoliating bark and conversely the absence of exfoliating bark defines *V. ozarkense*. This is an inviolate *Viburnum molle* character, used by Michaux in his type description, and observed by the author in the field for plants in Kentucky, Ohio, Missouri, and Arkansas, and on herbarium specimens of *V. molle* through its range in Tennessee, Indiana, Illinois, and Iowa. For determination of herbarium material collected without older stems, the suite of abundantly toothed leaf margins, short apex, and glabrous, terete petioles on yellow-tan twigs would lead one to *Viburnum molle*. Conversely, a specimen with moderately toothed leaves, longer, acute tips, and glandular-

pubescent, oval petioles on reddish-brown twigs would lead one to *Viburnum ozarkense*. These suites of characters allow for the differentiation of these two related species.

Viburnum ozarkense and *V. molle* co-occur in Madison County, Arkansas and Oregon County, Missouri, at the southwest edge of the range of *V. molle* (Fig. 3). In Arkansas the populations are about 30 air miles apart, while in Missouri the populations are about 12 river miles apart. No sympatric populations of *Viburnum molle* and *V. ozarkense* were located by the author, nor were any individuals appearing intermediate between these species observed in the field or voucher material examined.

Specimens examined: **Viburnum ozarkense** Ashe. **ARKANSAS: Baxter Co.:** Baxter Co.: 6 Jun 1931, *Ashe s.n.* (NCU); 7 Jun 1931, *Ashe s.n.* (NCU); 10 Jun 1931, *Ashe s.n.* (NCU, NY). **Benton Co.:** Devils Eyebrow, 22 Apr 1928, *Demaree 4842* (UARK). **Franklin Co.:** Devils Hollow, 3 Jun 1978, *Barber 849* (UAM, UARK). **Garland Co.:** creek banks, Ouachita River, 28 Aug 1939, *Demaree 20517* (MO); Walnut Creek Recreation Area, 10 Aug 1951, *Moore 510786* (UARK); rich woods, Charlton Recreation Area, 23 Apr 1994, *Sundell et al 10759* (NA, UAM). **Johnson Co.:** creek bank, Ozark National Forest, 14 Sep 1995, *Kirshberger & Davis 101* (UAM, UARK). **Madison Co.:** woods understory, S of Red Star, 18 Apr 1995, *Kirshberger 12* (UAM); mesic woods, vicinity Boston, 17 Nov 1973, *Tucker 12461* (SMU) Little Mulberry Creek, S of Red Star, 3 Jun 2001, *Weckman 6401-6419* (EKY). **Newton Co.:** Stepp Creek near Swain, 20 Jul 1979, *Bonar s.n.* (UARK); Boxley, 22 May 1948, *Moore 480226* (UARK); limestone woods above Buffalo River, 20 May 2000, *Weckman 5597A,B-5599* (EKY); upland woods Buffalo River, near Boxley, 20 May 2000, *Weckman 5603* (EKY). **Polk Co.:** creek banks, Bard Springs, 4 May 1955, *Demaree 36632* (SMU). **Pope Co.:** Snow Creek, N of Hector, 31 Oct 1978, *Boatright & Utley 102* (APCR); along creek bank, Hector, 17 Oct 1932, *Merrill 89* (A); creek bank, Nogo, 11 May 1933, *Merrill 271* (ILL. MO, UARK); rugged hills NE of Russellville, Aug 1955, *Moore et al 55-432* (UARK); rich woods along Indian Creek, SW of Pelsor, 10 May 1969, *Tucker 7926* (APCR). **Saline Co.:** bluffs, Alum Fork, Saline River, 28 May 1954, *Demaree 35333* (NCU, US); the Narrows, S of Crows, 24 Sep 1995, *Sundell & Pagan 11726* (UAM); narrow ridge, Saline River, 11 Jul 1997, *Walker 11079701* (UARK); N face slope above Alum Fork, 6 Jul 1999, *Weckman & Walker 5110, 5111, 5113, 5131* (EKY). **Searcy Co.:** rocky creek bluff, Harriet, 9 May 1970, *Demaree 61712* (MO); hillside, S of Marshall, 29 Apr 1967, *Graham 343* (NCU). **Stone Co.:** near Sylamore, n.d., *Ashe s.n.* (NCU); near Sylamore, 18 May 1924, *Ashe s.n.* (NCU); bottom of N Sylamore Creek, 7 Jun 1931, *Ashe s.n.* (NCU); along Cap Fork Creek, 6 May 1981, *Davis 2975* (APCR); creek bottom in woods, Mountain View, 10 May 1952, *Demaree 31751* (US, VDB); rocky hillsides, Blanchard Springs, 19 May 1952, *Demaree 31850* (NCU, US, VDB); rocky open woods, bluffs, Sylamore Creek, 19 May 1965, *Demaree 52296* (NCU); Barkshed Recreation Area, along N Sylamore Creek, 29 Apr 1967, *Graham et al 343* (APCR); Blanchard Springs, 18 Jun 1945, *Moore 450600* (UARK); Sylamore, 24 Jun 1945, *Moore 450629* (UARK); Sylamore Forest, 24 Jun 1945, *Moore 450646* (UARK); Blanchard Springs, 23 Jun 1945, *Moore 450721* (UARK); Blanchard Springs, 18 Aug 1948, *Moore 480735* (UARK); Caney Creek, N of Mt. View, 21 Jun 1951, *Moore 510347* (UARK); wooded N facing slope, Gunner Pool Recreation Area, 19-21 May 1978, *Redfearn 31673* (SMS); Big Creek, 9 May 1970, *Smith 1462* (UARK); above creek bed, vicinity of Blanchard Springs, 22 May 1984, *Sundell 6308* (UAM); along Sylamore Creek, 8 Oct 1966, *Tucker & Demaree 3578* (APCR); alluvial woods, Barkshed Recreation Area, 14 Oct 1967, *Tucker 6862* (APCR); alluvial woods along N Sylamore Creek, 14 Oct 1967, *Tucker 6867* (APCR, NCU); streamside, Blanchard Springs Recreation Area, 2 Oct 1969, *Tucker 8225* (APCR); rocky streambank, Blanchard Springs, 5 Aug 1972, *Tucker 10418* (UARK); rocky slope, Gunner Pool, 5 Aug 1972, *Tucker 10449* (APCR); along N Sylamore Creek, 8 Oct 1972, *Tucker 10605* (APCR - 2x, SMU, VDB); Cap Fork, Barkshed Recreation Area, 7 Jul 1999, *Weckman 5151, 5160-5168* (EKY); Blanchard Springs,

7 Jul 1999, *Weckman* 5172–5176, 5178–5184 (EKY). **Van Buren Co.:** sandstone bluffs, Little Red River, near Shirley, 28 May 1924, *Palmer* 25197 (A, MO, UARK). **Washington Co.:** Cove Creek Valley, 17 Aug 1954, *Hite* 102 (UARK). Unknown Co.: Arkansas, n.d., *anon. sn.* (NCU).

MISSOURI: Howell Co.: limestone slopes along Myatt Creek, 27 Apr 1938, *Steyermark* 5186 (F, MO); lime bluffs, Eleven Point River, 12 Aug 1934, *Steyermark* 14503 (MO, NA, US); shaded lime bluff, Eleven Point River, NE of Peace Valley, 12 Aug 1934, *Steyermark* 14503A, 14503B (UMO); Eleven Point River near Blowing Springs, 14 Apr 1935, *Steyermark* 18614 (UMO); S Fork Spring River, 26 Jun 1955, *Steyermark* 78762 (UMO); N face limestone slope, S Fork Spring River, 26 Jun 1955, *Steyermark* 78763 (UMO); limestone bluffs, S Fork Spring River, 26 Jun 1955, *Steyermark* 78765 (GH, MO, UMO); along S Fork Creek, 19 Jul 1979, *Summers* 527 (MO); ledges, bluff, dolomite glade, SE of Mt. View, 27 Jun 1990, *Summers* 3394 (MO); N face dolomite bluff, S Fork Spring River, 4 Jul 1990, *Summers* 3431 (MO); N face dolomite bluff, S Fork Spring River, 4 Jul 1990, *Summers* 3432 (MO); Eleven Point River at Blowing Springs, 14 Sep 1994, *Summers* 7102 (MO); Eleven Point River at Blowing Springs, 2 Jun 2001, *Weckman* 6360–6365, 6371–6385 (EKY); S Fork Spring River, N of Lanton, 2 Jun 2001, *Weckman* 6390–6393 (EKY). **Oregon Co.:** SW facing dolomite glade and bluff, 4 Aug 1993, *Summers* 6170 (MO).

OKLAHOMA: Adair Co.: rocky hillside, 14 May 1980, *Huft & Goodman* 1160 (OKL); chert slope above Caney Creek, 27 Apr 1968, *Perino & Pierson* 168 (OKL); NW of Stilwell, 13 Jun 1957, *Rice s.n.* (GH, OKL, OKLA); NE of Stilwell, 2 May 1959, *Rice s.n.* (OKLA); chert slope above Caney Creek, 19 May 2000, *Weckman* 5577–5587 (EKY). **McCurtain Co.:** oak-pine woods in mountains, S of Bethel, 9 Aug 1948, *Waterfall* 8515 (OKL, OKLA); wooded hill, S of Bethel, 4 Jun 1949, *Waterfall* 8826 (OKLA); open woods, base of mountains, N of Broken Bow, 24 Jun 1966, *Waterfall* 17228 (NCU, OKLA).

Viburnum molle Michx. **ARKANSAS: Boone Co.:** rocky ledges, Harrison, 25 Oct 1914, *Palmer* 6914 (A, MO, US). **Madison Co.:** ledge, limestone bluff, War Eagle Creek, 15 May 1987, *Shepherd & Smith* 286 (UARK); base of bluff, War Eagle Creek, N of Huntsville, 4 Jun 2001, *Weckman & Shepherd* 6420–6441 (EKY). **MISSOURI: Barry Co.:** wooded slopes of Piney Creek, 22 Jun 1937, *Steyermark* 22597 (A, F, MO). **Benton Co.:** bluffs of Cole Camp Creek, 28 May 1896, *Demetrio s.n.* (MU, NCU, US); bluffs of Cole Camp Creek, vicinity of the Big Cave, 27 May 1897, *Demetrio s.n.* (GH); Cole Camp Creek, May 1905, *Fullgraf sn* (MO); Cole Camp Creek, 30 Aug 1896, *Heck s.n.* (GH); Bluffs of Cole Camp Creek, vicinity of Big Cave, 9 May 1897, *Heck s.n.* (GH); N facing slopes, ledges, Big Cave bluff, 2 Oct 1924, *Palmer* 26370 (A, GH, MO, MOR, UMO); N facing ledges, Big Cave bluff, 12 May 1926, *Palmer* 30061 (A, MOR, UMO); bluffs, Cole Camp Creek, 24 Sep 1938, *Steyermark* 7289 (F); Cole Camp Creek, 19 May 1904, *Trelease* 4 (A); Big Cave, Cole Camp Creek, 12 Jul 1897, *Trelease* 383 (NCU); Big Cave, Cole Camp Creek, 12 Jul 1897, *Trelease* 384 (A, MO); Cole Camp Creek, n.d., *anon. s.n.* (A). **Callaway Co.:** N. limestone slopes along Middle River, 12 Sep 1937, *Steyermark* 26203 (F, MO) steep slopes, Stinson Creek, 12 Sep 1937, *Steyermark* 26235 (F, MO); N slopes, Stinson Creek, 25 May 1948, *Steyermark* 65464 (F). **Christian Co.:** along Billin Creek, 28 Sep 1905, *Bush* 3480 (A, MO); rich woods, 21 May 1907, *Bush* 4625 (A, MO); bluffs, Swan Creek near Garrison, 28 Oct 1955, *Palmer* 61802 (UMO); N facing wooded slope along Woods Fork, 9 May 1981, *Redfearn* 32647 (SMS, UMO); E and NW facing bluffs, Swan Creek, 6 Jul 1937, *Steyermark* 23039 (F, NY). **Crawford Co.:** rocky woods along stream, Zahorsky Woods, 25 Aug 1983, *Christ s.n.* (MO); cliff base, Meramec River, 12 Sep 1986, *Rogers* 216 (MO); hillside near Steelville, May 1929, *Shoop s.n.* (UMO); lime bluffs, Meramec River, 21 Oct 1934, *Steyermark* 16317 (MO, US); lime bluffs, SE of Bourbon, 21 Oct 1934, *Steyermark* 16317A, 16317B (UMO); steep slopes, Meramec River, 15 Jun 1941, *Steyermark* 41332 (F, GH); steep slopes S side Meramec River, 15 Jun 1941, *Steyermark* 41339 (F, GH, MO, US); base of slope, Meramec River, 15 Jun 1941, *Steyermark* 41341 (F, GH); NE face, Meramec River, 11 Jun 1955, *Steyermark* 78602 (UMO). **Lincoln Co.:** N face bluffs W Fork Cuivre River, 28 Apr 1941, *Steyermark* 28516 (F, GH, MO); **McDonald Co.:** rich hillsides, Noel, 25 Apr 1909, *Bush* 5531 (A); rich woods, Noel, 27 May 1909, *Bush* 5763 (A). **Madison Co.:** limestone bluff, outcrops, Castor River, 27 Aug 1948, *Steyermark* 66097 (F). **Oregon Co.:** limestone bluffs, Eleven Point River, 1 May 1986, *Summers* 1589 (MO); Cane Bluff, Eleven Point River, 1 Jun 2001, *Weckman* 6350–

6359 (EKY). **Pulaski Co.:** N facing limestone slopes, Gasconade River, 24 Aug 1937, *Steyermark* 25268 (F, MO); N limestone bluffs, Gasconade River, 10 Sep 1956, *Steyermark* 82532A, 82532B (UMO). **Phelps Co.:** N facing bluff, Gasconade River, 2 May 1991, *Summers* 4248 (MO). **St. Genevieve Co.:** talus slopes, ledges, Jonca Creek, 17 Jun 1993, *Brant* 2398 (MO); NW facing lime bluff, River Aux Vases, 6 Jul 1946, *Steyermark* 63872 (F); NW facing lime bluff, River Aux Vases, 6 Jul 1946, *Steyermark* 63873 (F). **Stone Co.:** cliffs of James River, 15 Oct 1913, *Palmer* 4671 (A, US); high limestone bluffs, James River, 20 May 1914, *Palmer* 5671 (NY, US); high limestone bluff, James River, 11 Sep 1918, *Palmer* 14361 (A); high limestone bluffs, James River, 17 Apr 1920, *Palmer* 17226 (A); N high lime bluffs, James River, 23 May 1923, *Palmer* 22816 (A, MO, MOR, UMO, US); high limestone bluffs, James River, 24 Sep 1923, *Palmer* 23872 (A, SIU); high limestone bluffs, James River, 24 Sep 1923, *Palmer* 23872a (A, MOR); N face, limestone ledges, James River, 16 Sep 1924, *Palmer* 26158 (A, MOR); N face limestone bluffs, James River, 16 Sep 1924, *Palmer* 26158a (A, MO, MOR); mesic forested dolomite bluff, James River, 23 Jun 1988, *Smith* 2733 (MO, SMS); wooded bluff along James River, 22 Jun 1941, *Steyermark* 40133 (F). **Taney Co.:** bluffs along Swan, 9 Oct 1899, *Bush* 798 (GH, MO, NCU, ND-G, NY, US); rich banks, Swan, 26 Sep 1905, *Bush* 3449 (A, GH, NY, US); cliffs of Swan River, 8 Oct 1894, *Sargent* s.n. (A). **Texas Co.:** Jacks Fork, Current River, 26 Aug 1939, *Bauer* 867 (F); rocky slopes, dolomitic bluff, Jacks Fork, 1 Aug 1969, *Redfearn et al* 899 (MO, NCU, SMS); lime bluffs, slopes, Jacks Fork Current River, 15 Aug 1934, *Steyermark* 14574 (GH, MO); lime bluffs, slopes, Jacks Fork Current River, 15 Aug 1934, *Steyermark* 14574A, 14574B (UMO); N face limestone bluff, N Prong of Jacks Fork, 27 Apr 1952, *Steyermark* 73117 (F, UARK); N face dolomite bluff, Jacks Fork, 21 Aug 1990, *Summers* 3625 (MO). **Warren Co.:** Lost Creek State Forest, 4 Jun 1987, *Christ* s.n. (MO); limestone bluffs along Lost Creek, 9 Jun 1946, *Steyermark* 63705 (F).

ACKNOWLEDGMENTS

I would like to thank Stephen Walker who introduced me to the unusual “*V. molle*” of Arkansas and Bill Shepherd for facilitating re-location the *V. molle* population he discovered in Arkansas in 1987. Additionally, Johnnie Gentry, Burnetta Hinterthuer, Philip Hyatt, Lang Kirshberger, Gene Leeds, Janet Self, Karen Tinkle and Gary Tucker shared valuable locality information and provided logistical support in Arkansas. In Missouri, essential locality information was provided by Bill Summers and George Yatskievych. Analysis of statistical data was greatly facilitated by Judith Weckman. This work was supported in part by funding from the Office of the Dean, College of Arts and Sciences, Eastern Kentucky University. Finally, I am indebted to the curators of the herbaria listed above who generously lent from the specimens in their care.

REFERENCES

- ASHE, W.W. 1928. Notes on southeastern woody plants. *Bull. Torrey Bot. Club* 55:463–464.
- COKER, W.C., J.S. HOLMES, and C.F. KORSTIAN. 1932. William Willard Ashe. *Elisha Mitchell Sci. Soc.* 48:40–47.
- ESTILL, J.C. and M.B. CRUZAN. 2001. Phytogeography of rare plant species endemic to the Southeastern United States. *Castanea*. 66:3–23.
- HOLMGREN, P.K., N.H. HOLMGREN, and L.C. BARNETT (eds.). 1990. *Index Herbariorum*. Part 1: The Herbaria of the World, 8th edition. New York Botanical Garden, Bronx, NY.

- MASSEY, J. 2001. Personal communication.
- MCATEE, W.L. 1956. A review of the nearctic *Viburnum*. Privately published by the author. Chapel Hill, North Carolina.
- MICHAUX, A. 1803. Flora Boreali-Americana. 2 volumes. Paris and Strasbourg. Facsimile reprint. Introduction by J. Ewan 1974. Hafner Reprint, New York.
- MOORE, D.M. 1941. A checklist of the ligneous flora of Arkansas. Proc. Arkansas Acad. Sci. 1:41–55.
- SMITH, E.B. 1988. An atlas and annotated list of the vascular plants of Arkansas. Privately published by the author. Fayetteville, Arkansas.
- STEYERMARK, J.A. 1963. Flora of Missouri. Iowa State University Press, Ames.
- TUCKER, G.E. 1976. A guide to the woody flora of Arkansas. PhD dissertation, University of Arkansas, Fayetteville.
- USDA, NRCS. 2002. The Plants Database, Version 3.5 (<http://plants.usda.gov>). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.